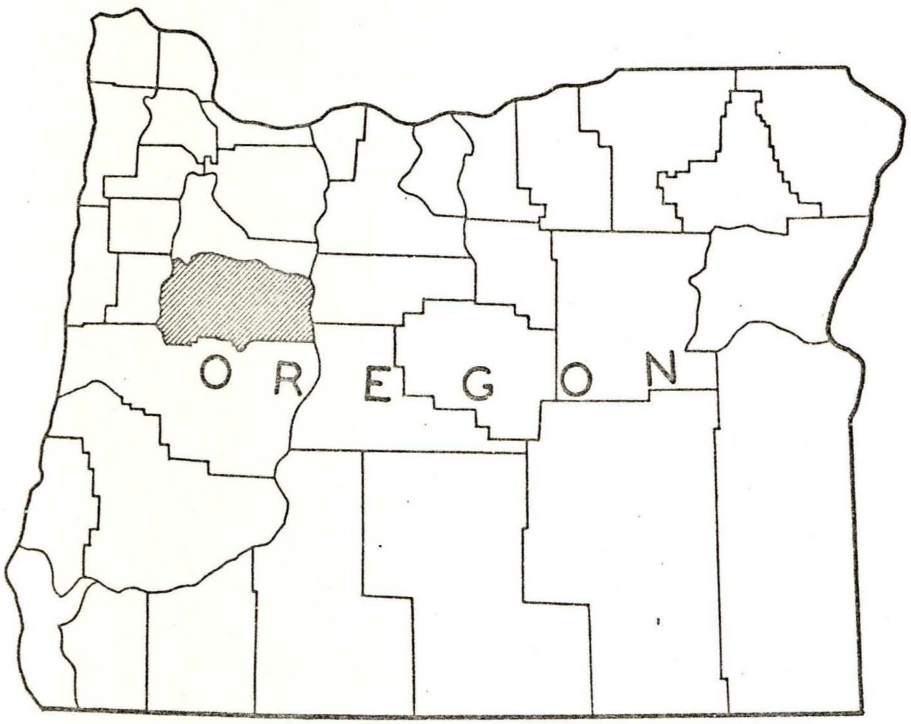
FORESTRY LIBRARY
250 FORESTRY BUILDING
UNIVERSITY OF CALIFORNIA
BERKELEY

FOREST STATISTICS
for
LINN COUNTY, OREGON

FROM THE FOREST SURVEY INVENTORY REVISED IN 1944

FOREST SURVEY REPORT NO. 95



U.S. DEPARTMENT OF AGRICULTURE — FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
STEPHEN N. WYCKOFF, DIRECTOR

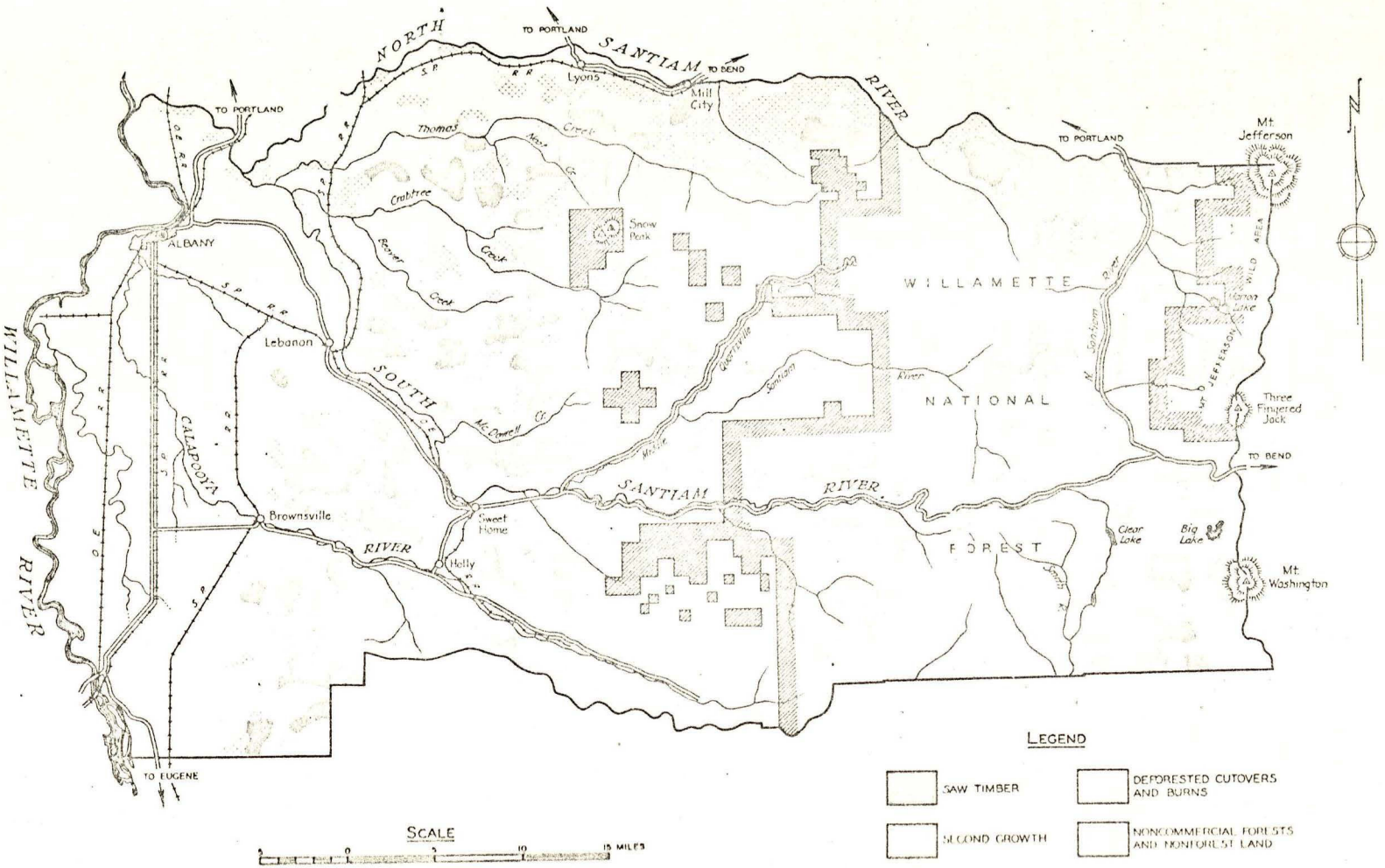
R.W. COWLIN, IN CHARGE OF FOREST SURVEY
PORTLAND, OREGON

F. L. MORAVETS, ASSISTANT
MARCH, 1945

FIGURE I

OUTLINE MAP of LINN COUNTY, OREGON

1944



FOREWORD

The forest survey, a Nation-wide project, consists of a detailed investigation in five major parts of present and future forest resources: (1) An inventory of the country's existing forest resources in terms of areas occupied by forest-cover types and of timber volumes, by species, in board feet and cubic feet, and a study of conditions on cut-over and on burned forest lands; (2) a study of the depletion of the forests through cutting and through loss from fire, insects, disease, and other causes; (3) a determination of the current and potential growth on forest areas; (4) an investigation of present and prospective requirements of the United States for forest products; and (5) an analysis and correlation with other economic data of findings of these studies in order to make available basic facts and guiding principles necessary to plan for sound management and use of forest resources.

The forest survey of Oregon and Washington, an activity of the Pacific Northwest Forest and Range Experiment Station, was conducted in the Douglas-fir region during the period 1930-33.1/ In 1937, work of keeping the survey up to date was commenced in counties in which there had been a large amount of cutting depletion since the original survey.

In Linn County, Oregon, the first inventory was conducted in 1931 and 1932, and tables summarizing the statistical data and a detailed forest type map were issued as of January 1, 1933. A reinventory of the county's forests was conducted late in 1943 to bring the forest statistics and type map up to date. Adjustments, based on field examinations, were made for changes due to logging, fire, restocking of cut- and burned-over areas, and transfer of land ownership since the original survey. Revised statistics, as of January 1, 1944, are given in this report, and prints of the revised county type map may be obtained.2/

1/ Oregon and Washington were divided for survey purposes into two regions; (1) Douglas-fir region, consisting of that part of both States west of the Cascade Range summit, and (2) ponderosa pine region, that part of both States east of the Cascade Range summit. A regional report which includes an interpretation of the forest survey data and analysis of the forest situation has been published for each of the two regions.

2/ For information on the detailed 1-inch-to-the-mile forest type map of the county or the 1/4-inch-to-the-mile lithographed State type maps covering Oregon and Washington, address Director, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Oregon.

FOREST STATISTICS FOR LINN COUNTY, OREGON

Contents

	Page
Introduction	1
Physical character of county	2
Land use pattern	3
Forest land	6
Conifer saw timber	8
Immature conifers	10
Hardwoods	10
Recent cutovers	11
Deforested lands	11
Noncommercial types	12
Productive capacity	12
Saw-timber volume	15
Forest ownership	15
Private	15
Federal	16
State, county, and municipal	17
Forest growth	18
Forest depletion	19
Forest industry	20
The forest situation summarized	22
Comparison of inventories	

Figures

1. Outline map of Linn County, Oregon — Inside cover

Tables

1. Area, in acres, of all forest cover types, by ownership class — 4
2. Area, in acres, of generalized forest types, by ownership class — 5
3. Area, in acres, of certain immature conifer types by age class and degree of stocking — 9
4. Land areas, forest land areas, and commercial conifer areas by site quality class — 13
5. Volume of timber by species and ownership class — 14
6. Current annual growth, by forest type group, 1943 — 17
7. Potential annual growth of commercial conifer land — 18
8. Average annual production of sawlogs and lumber for specified periods, 1925-1943 — 19

FOREST STATISTICS FOR LINN COUNTY, OREGON

By G. S. Meagher[1/]

Although Linn County has long been one of the leading agricultural counties of western Oregon, only a small portion of its total timber resource had been utilized when the present world conflict started in Europe in 1939. Since that date, the logging and wood-using industries of the county have expanded tremendously due both to the greatly increased demand for lumber to meet war requirements, and to the growing scarcity of old-growth timber in other parts of northwestern Oregon and western Washington. In the 5-year period, 1939 to 1943, lumber production doubled, and sawlog production increased four times. With a record cut of 729 million board feet in 1943, Linn ranked second among the 19 western Oregon counties in sawlog production.

The rapid expansion of forest industry has brought a substantial increase in population, employment, and income, and a general broadening of the economic base within the county. Whether or not the present logging and lumbering activity can be molded into a permanent forest industry of large size depends both upon the size and character of the forest resource and upon the extent to which sound forestry practices are employed in the management of forest lands.

The present report has been prepared to furnish a general picture of the forest situation in Linn County, including basic information on forest types and timber volumes, current depletion resulting from cutting, fires, and other agencies, and current and potential growth rates.

Physical Character of County

With a total land area of nearly 1½ million acres, Linn is the fourth largest of western Oregon counties. Situated in the east-central portion of the Willamette River basin, it extends from the Willamette River on the west to the summit of the Cascade Range on the east and from the North Santiam River to the Calapooya Mountains in a north-south direction. The county boundaries enclose a rectangular area roughly 70 miles long and 32 miles wide (figure 1).

Topographical features divide the county into three fairly distinct zones. The floor of the Willamette Valley borders the Willamette River along the western edge of the county in a belt 10 to 18 miles wide. The flood plains and terrace lands of this zone are practically all level or gently rolling with an altitudinal range of 200 to 300 feet.

1/ Field work of the revised inventory was by P. A. Briegleb, G. E. Morrill, and G. S. Meagher; office compilation was by Inga E. Fulkerson, Dorothy Masche, E. R. Grosh, and D. N. Greenlees.

Table 1.--Area, in acres, of all forest cover types, by ownership class
Data corrected to January 1, 1944

Type No.	Type	Private	State		County	Municipal	Federal				Total
			Available	Reserved			Revested land grant	Public domain	National forest Available	National forest Reserved	
4	Woodland: oak-madrone	8,985									8,985
	Douglas-fir										
6	Large old growth	119,395	565		700		10,135	130	89,105	45	220,075
7	Small old growth	73,175	80		855		14,490	235	93,250	1,830	184,215
8	Large second growth	68,425	85	130	1,020		5,380	110	46,360	1,315	122,825
9	Small second growth	95,905	5,025	40	4,240	25	10,635	825	56,890	3,490	177,075
10	Seedlings and saplings	21,975	7,925		1,495		4,335	270	9,430		45,430
	Western hemlock										
14	Large	9,135	25				2,180	5	6,865		18,210
15	Small	5,445			155		720	135	580		7,035
16	Seedlings and saplings	1,010			20		255		140		1,425
	Ponderosa pine										
21	Small	155									155
22	Seedlings, saplings, & poles	55									55
	Fir-mountain hemlock										
23	Large	5,805			115		515		40,680	16,615	63,730
24	Small	1,105	5		265		15	10	17,595	9,995	28,990
26	Lodgepole pine, small	90							16,100	1,080	17,270
	White fir										
29	Large	185									185
30	Small	25			30		85				140
	Hardwood										
31.5	Large	7,735	25		60	95	65	45	110		8,135
31	Small	17,865	275	25	150		375	110	165		18,965
33	Subalpine								1,735	6,955	8,690
	Nonrestocked cutover										
35	Cut prior to 1920	85									85
35A	Cut from 1920-29, incl.	1,710	1,340		635		1,165		5		5,155
36	Recent cutover, since 1930	75,215	2,485	15	1,985		7,840	150	2,610		90,300
37	Deforested burn	6,810	1,215		295		945	60	2,305	545	12,175
38	Noncommercial rocky area	1,265	25				140		23,405	435	25,270
	Total forest types	521,555	19,075	210	12,020	120	59,575	2,085	407,630	42,305	1,064,575
	Nonforest land										
3	In agricultural use	388,200	1,375	120	395		215	305	50		390,660
2	Other	6,945	35		65	30	135		12,295	3,245	22,810
	Total	916,720	20,485	330	12,460	150	59,925	2,390	419,975	45,550	1,478,045

Table 2.--Area, in acres, of generalized forest types, by ownership class
Data corrected to January 1, 1944

Type definition	Private	State		County	Municipal	Federal				Total
		Available	Reserved			Revested land grant	Public domain	National forest Available	National forest Reserved	
Conifer saw timber Types 6, 7, 8, 14, 23, and 29	276,120	755	130	2,690		32,700	480	276,560	19,805	609,240
Conifer second growth Types 9, 15, 21, 24, and 30										
On cut-over areas	36,090	3,240		685	25	1,380	40	690		42,150
On old burns	66,490	1,790	40	3,765		10,075	930	70,535	11,025	164,650
Total	102,580	5,030	40	4,450	25	11,455	970	71,225	11,025	206,800
Conifer seedlings and saplings Types 10, 16, 22, and 24										
On cut-over areas	9,510	6,650		855		1,635		1,980		20,630
On old burns	13,585	1,275		900		2,955	270	11,430	2,460	32,875
Total	23,095	7,925		1,755		4,590	270	13,410	2,460	53,505
Recent cut-over areas Type 36	75,215	2,485	15	1,985		7,840	150	2,610		90,300
Nonrestocked cut-over and burned-over areas Types 35, 35A, and 37	8,605	2,555		930		2,410	60	2,310	545	17,415
Hardwoods Types 31 and 31.5	25,600	300	25	210	95	440	155	275		27,100
Noncommercial areas Types 4, 26, 33, and 38	10,340	25				140		41,240	8,470	60,215
Total forest types	521,555	19,075	210	12,020	120	59,575	2,085	407,630	42,305	1,064,575
Nonforest land Types 2 and 3	395,165	1,410	120	440	30	350	305	12,305	3,345	413,470
Total	916,720	20,485	330	12,460	150	59,925	2,390	419,935	45,650	1,478,045

Douglas-fir is the outstanding tree species; it predominates on 86 percent of the commercial conifer area, and comprises 77 percent of the saw-timber volume and 85 percent of the sawlog production. At lower elevations, western hemlock, western redcedar, and grand fir are often associated in Douglas-fir types; at higher elevations, western hemlock, western white pine, and noble fir occur frequently. Above the 3,500 foot level, Douglas-fir types are gradually replaced by upper-slope mixtures with mountain hemlock, or balsam firs predominating. Hardwood species, largely Oregon white oak, Oregon ash, or northern black cottonwood form the characteristic cover of the scattered woodlands of the valley zone.

Altogether, 24 forest types, segregated on the basis of species composition, tree size, and stand condition were recognized and mapped; 14 are commercial conifer, 2 are commercial hardwood, and 4 each are noncommercial forests and denuded forest land.

Area statistics for each type by ownership class are given in table 1. A more generalized grouping is shown both in the map of figure 1 and in table 2. About three-fifths of Linn County's forest land supports stands of saw-timber size, one-quarter is occupied by immature second growth, one-tenth is currently deforested and the remainder is occupied by noncommercial stands.

Conifer Saw Timber

Conifer stands, with the majority of their volume in trees 20 inches 2/ d.b.h. or larger, and otherwise suitable for sawlogs, were classed as saw timber in the survey. Saw-timber stands blanket a large part of the mountain zone and smaller areas in the foothills with a total area of slightly over 609,000 acres.

Large old-growth Douglas-fir (type 6) accounts for one-third of the saw-timber area with a total acreage of about 220,000 acres. In terms of both area and volume, it is the number one type of the mountain zone. Usually found at elevations below 2,500 feet, type 6 stands are fairly accessible and have furnished a large portion of the timber cut in commercial logging operations. The majority of these stands are 350 years or more in age, and contain fine-grained timber of fairly high quality. A younger age class, which occupies several blocks adjacent to the foothill zone, however, contains timber that is relatively rough and coarse grained. Dominant trees in type 6 stands vary from 40 to 96 inches in diameter and 7 to 14 in height.

Small old-growth Douglas-fir (type 7) is also confined to the mountain zone where it occupies large areas between elevations of 2,500 and 4,000 feet. Type 7 stands, with a total acreage of about 184,000

2/ Sixteen inches d.b.h. or larger for the fir-mountain hemlock type.

acres, comprise the second most extensive forest type in the county. Ages in type 7 stands are usually about the same as for the adjoining type 6 stands and the smaller tree size is accounted for by a generally poorer site. The average dominant tree is about 30 inches in diameter and from 6 to 7 logs in merchantable height.

In general, defect in the old-growth Douglas-fir timber in Linn County averages greater than in most other sections of northwest Oregon. It is particularly high in blocks and fringes of timber on the lower foothills adjacent to the agricultural zone.

Douglas-fir stands less than 160 years of age that have attained saw-timber size were classed as large second-growth Douglas-fir (type 8). The bulk of the saw-timber stands of the foothill zone are of this size and age class and several large blocks also occur in the mountains, notably near the headwaters of the North Santiam and McKenzie Rivers, and along the lower reaches of the South and Middle Forks of the Santiam. Varying in age from 50 to 160 years, type 8 stands aggregate almost 123,000 acres. The Douglas-fir timber in this type is generally rough and coarse grained but defect due to decay is less a factor than in the older fir stands. The more accessible areas of type 8, especially those in the foothill zone, have been extensively cut for second-growth saw-logs and piling.

Saw-timber stands with a majority of the volume in western hemlock (type 14) are found on some 18,000 acres in the mountain zone. Usually situated near the upper altitudinal limits of the Douglas-fir types, the stands of hemlock saw timber are relatively inaccesible at the present time and have been little disturbed by logging. Individual tracts seldom cover more than 1,500 acres and they usually contain, in addition to hemlock, a fairly heavy mixture of Douglas-fir, noble fir, and Pacific silver fir. The hemlock, which varies from 20 to 60 inches in diameter and from 2 to 11 logs in length, is of fairly good quality.

Fir-mountain hemlock stands of saw-timber size (type 23) are fairly extensive in the mountain zone from elevations of about 3,500 feet to the upper limits of commercial forest types reached at about 5,000 feet. With a total area of almost 64,000 acres, stands of this class have a majority of their volume in mountain hemlock, Pacific silver fir, noble fir, or various combinations of these species. Western white pine, Douglas-fir, and western hemlock frequently comprise a substantial portion of the volume in upper-slope mixtures, and Engelmann spruce, Alaska yellow cedar, lodgepole pine, and alpine fir are of more limited occurrence. Located in inaccessible areas and containing a relatively low timber volume, these upper-slope mixtures have been logged little but have a high potential value especially as a source of pulpwood.

While grand fir is often associated in Douglas-fir saw-timber types, it comprises a majority of the stand (type 29) on only three very small areas, all located at low elevations in the foothill zone.

Immature conifers

Conifer second growth of less than saw-timber size covers some 260,000 acres. Three-quarters of these stands, by area, are of pole size (6 inches d.b.h. and larger) and one-quarter is in the seedling or sapling stage (less than 6 inches d.b.h.).

Several large blocks of pole-size timber are found in the mountain zone; the largest forms a belt 15 miles long and 2 to 5 miles wide along the South Santiam River; a second narrow strip follows the North Santiam River from Mill City to Idanha and an irregular band a few miles west of the Cascade Divide forms a third. The remainder of the pole stands is largely accounted for by scattered tracts in the foothill zone. Eighty-six percent, by area, contains Douglas-fir in the majority (type 9), 3 percent is dominated by western hemlock (type 15), and 11 percent supports fir-mountain hemlock mixtures (type 24). In addition, grand fir (type 30) and ponderosa pine (type 21) occupy three very small tracts in the foothill zone.

Pole-size stands vary in age from 20 to 110 years with the majority in the 30-to 60-year age bracket (table 3). The Douglas-fir and hemlock types of this size class have an average age of about 45 years; the fir-mountain hemlock types are, on the average, about 20 years older. Tree density is generally good, with one-third of their area well stocked, three-fifths of medium stocking, and only one-fifteenth poorly stocked. The weighted average for all pole stands is 64 percent of full stocking. As shown in table 2, three-fifths by area restocked following fires, and two-fifths originated on lands cut over in logging operations.

Conifer stands of seedling and sapling size, aggregating about 53,000 acres, are largely accounted for by four large blocks in the mountain zone. One block, situated in the Rock Creek drainage, is a restocked cutover; the others in the Crabtree, Sevenmile, and lower Quartzville Creek basins all represent restocked burns. Distribution of types within the seedling and sapling stands is almost identical to that of the pole stands with 85 percent of their area dominated by Douglas-fir (type 10), 3 percent by western hemlock (type 16), and 12 percent by mixed stands of balsam fir and mountain hemlock. In addition, one small tract of 55 acres in the foothill zone supports a sapling-size stand of ponderosa pine (type 22).

Ages in seedling and sapling stands vary from 10 to 40 years but the largest acreages are in the 10- and 20-year classes. By area, two-fifths represent restocked cutovers and three-fifths are comprised of restocked burns.

The seedling and sapling stands of Linn County are exceptionally well stocked for stands in this age bracket; four-fifths, by area, were classed as medium or well stocked and only one-fifth was placed in the poorly stocked category. Average tree density in all stands of seedling or sapling size is 57 percent of full stocking.

Table 3.--Area, in acres, of certain immature conifer types by age class and degree of stocking

Data corrected to January 1, 1944

Age class (years)	Degree of stocking	Type number and name: 10 Douglas-fir seedlings and saplings	9 Douglas-fir small second growth	16 Western hemlock seedlings and saplings	15 Western hemlock small second growth	24 Fir-mountain hemlock second growth	21, 22, & 30 Other[1] second growth	Total
10	Good	3,525						3,525
	Medium	13,215				440		13,655
	Poor	7,475						7,475
	Total	24,215				440		24,655
20	Good	7,960	995					8,955
	Medium	9,000	9,840	870	45	1,285		21,040
	Poor	2,245	1,725					3,970
	Total	19,205	12,560	870	45	1,285		33,965
30	Good	1,415	6,795	355	1,145	640		10,350
	Medium	180	17,520	95	600	3,790		22,185
	Poor	415	3,460			440		4,315
	Total	2,010	27,775	450	1,745	4,870		36,850
40	Good		15,770	105	2,100	235		18,210
	Medium		26,160		1,875	4,345	140	32,520
	Poor		4,360					4,360
	Total		46,290	105	3,975	4,580	140	55,090
50	Good		11,225		990			12,215
	Medium		21,060			965	55	22,080
	Poor		3,635					3,635
	Total		35,920		990	965	55	37,930
60	Good		29,515			615		30,130
	Medium		15,625			7,775	85	23,485
	Poor		1,250				70	1,320
	Total		46,390			8,390	155	54,935
70	Good		395					395
	Medium		2,690			2,085		4,775
	Poor		345					345
	Total		3,430			2,085		5,515
80	Good		350			110		460
	Medium		2,180			500		2,680
	Poor		90		280			370
	Total		2,620		280	610		3,510
90+	Good		350			1,105		1,455
	Medium		1,740			4,660		6,400
	Poor							
	Total		2,090			5,765		7,855
Total all ages	Good	12,900	65,395	460	4,235	2,705		85,695
	Medium	22,395	96,815	965	2,520	25,845	280	148,820
	Poor	10,135	14,865		280	440	70	25,790
	Total	45,430	177,075	1,425	7,035	28,990	350	260,305

1/ Ponderosa pine and white fir.

Hardwoods

Stands predominately hardwood, which account for about 27,000 acres, are mostly located in the scattered forest tracts of the valley zone. Thirty percent of the hardwood acreage supports timber 12 inches in diameter or larger and was classed as merchantable (type 31.5); 70 percent, stocked with trees below merchantable size, was classed as small hardwood (type 31). Thirty-six percent of the hardwood area is predominantly black cottonwood, 28 percent Oregon ash, 14 percent red alder, and 3 percent bigleaf maple; 19 percent contains varying mixtures of these hardwood species. Black cottonwood borders most of the large rivers in the valley portion of the county, while Oregon ash usually occupies the swales and other poorly drained areas. Red alder and bigleaf maple, both characteristic of low elevations in the foothill and mountain zones, frequently occur as understory trees in old-growth conifer stands and occasionally form limited hardwood types on the moist bottomlands bordering streams. Relatively few hardwood stands have been cut in commercial logging operations, although black cottonwood is occasionally cut as pulpwood and Oregon ash is widely used by valley residents for fuel.

Recent Cutovers

Areas clear-cut since 1930 were classed as recent cutovers (type 36) and due to the relatively short period that has elapsed since many of these areas were cut over they were not examined to determine the extent of restocking. Altogether, slightly over 90,000 acres, representing one-twelfth of the total forest land, were clear-cut during the 13-year period. The largest concentration of recent cutovers is found along the west front of the Cascade Range in a belt extending 6 to 10 miles east from the foothill zone. Cutting has been particularly heavy in the areas drained by Wiley, McDowell, Hamilton, Roaring, and Neal Creeks. Smaller cutovers extend further east along the South Santiam River and its two principal tributaries, Quartzville Creek and Middle Fork. Logging has penetrated the forest zone deepest along the North Santiam River where scattered type 36 areas extend to within 6 miles of the Cascade Divide. Small cutovers are also widespread throughout the second-growth stands of the foothill zone. Individual cutovers are relatively small, averaging less than 1,000 acres in extent. The majority are intermingled with blocks of green timber and should restock naturally within a 5- to 10-year period if adequately protected from fire. Conditions for natural restocking are somewhat less favorable in the two large cutovers of the Wiley and McDowell Creek drainages, each of which embraces about 7,000 acres.

In addition to the areas clear-cut, some 18,000 acres of existing stands have been partially cut, largely in pole, piling, tie-mill or fuelwood operations. Of the partially cut stands, 90 percent, by area, are second-growth Douglas-fir (types 8 or 9) and the majority are located in or near the foothill zone. These residual stands have resulted largely from high-grading practices and where a substantial portion of the stand

has been removed the productivity of the area has often been sharply reduced.

Deforested Lands

Nonrestocked cutovers and burns account for only 2 percent of the forest land in Linn County. Deforested burns (type 37), which cover about 12,000 acres, occur in many portions of the mountain zone, usually as small tracts of 400 acres or less. The largest type area, embracing about 1,200 acres, is located in the Crabtree Creek drainage.

Two classes of nonrestocked cutovers were recognized in the survey: Those cut prior to 1920 (type 35), and those cut between 1920 and 1929 (type 35A). Practically all of some 20,000 acres cut prior to 1920 had restocked by 1943; of about 14,000 acres cut during the following decade, almost two-fifths contained too few seedlings in 1944 to be classed as restocked. The 5,000 acres of type 35A are mostly concentrated in two small watersheds; some 2,500 acres are located in the Parson's Creek area along the county's south boundary, and about 2,000 acres are found in the Rock Creek basin in the north-central portion of the county. The present nonrestocked status of the Parson Creek cutover is due, in part, to a reburn in 1932.

Noncommercial Forests

Forest types of noncommercial character account for 6 percent of Linn County's forest land, totaling some 60,000 acres. This figure includes stands of lodgepole pine, subalpine or timber-line forests, oak woodlands, and noncommercial rocky areas.

Lands within the altitudinal range of commercial timber too rocky, too steep, or too sterile to produce a stand of commercial size and quality were classed as noncommercial rocky areas (type 38). Of a total of about 25,000 acres, three-fifths are composed of lava fields that extend south and west of Mt. Washington. Rocky ridge tops and cliffs, which cover small tracts in many parts of the mountains, make up the remainder of the type area.

Stands of small lodgepole pine represent the second largest noncommercial type, covering slightly over 17,000 acres within the general altitudinal range of fir-mountain hemlock stands. In some areas, lodgepole has seeded in following fires and forms a temporary cover that will be replaced eventually by the original species; in others, it forms a more permanent type on sites too poor to support commercial forests. Lodgepole pine in Linn County usually succumbs to insect attack before it reaches an age of 100 years, or a diameter of 12 inches. The most extensive stands are found in the lava and cinder areas near Mt. Washington.

Scrubby, open stands of alpine fir and mountain hemlock form a subalpine forest (type 33) just below timberline on the slopes of Mt. Jefferson, Mt. Washington, and Three Fingered Jack. Covering almost 9,000 acres, the subalpine types are of negligible timber value but add appreciably to the watershed protection and recreational assets of the timber-line areas.

Also included in the noncommercial category are about 9,000 acres of oak woodland (type 4). Often forming dense, almost pure stands on drier sites of the valley zone, Oregon white oak seldom attains saw-timber size and quality but is used locally for fuel.

Productive Capacity

The productive capacity of the forest land varies widely with the many combinations of climate, soil, drainage, and topography encountered. In the survey, the relative productive capacity or site quality of the 977,000 acres of commercial conifer land was rated, depending upon type, according to one of three standard site classifications--Douglas-fir, spruce-hemlock, or ponderosa pine. The resulting statistics (table 4) show that Linn County's forest land is about average in timber growing ability for lands on the western slopes of the Cascade Range in Oregon.

Of some 855,000 acres rated according to capacity to grow Douglas-fir, less than one percent qualified as site classes I or V, the most productive and least productive classes, respectively. Nine percent was found to be site class II, 77 percent site class III, and 13 percent site class IV.

Approximately 122,000 acres, including the white fir and fir-mountain hemlock types as well as those of western hemlock, were rated according to the spruce-hemlock site classification. Usually occurring at high elevations in a habitat of thin soils, severe climate, and a short growing season, these types are generally less productive than those of Douglas-fir. Only one percent qualified as site class II, and 18, 53, and 28 percent respectively were found to be in site classes III, IV, and V. The almost negligible area occupied by ponderosa pine was found to be site II in the pine classification.

Saw-Timber Volume

With a saw-timber volume of 26.8 billion board feet, log scale, Scribner rule, Linn County contains roughly 10 percent of the saw timber remaining in western Oregon. Only two Oregon counties, Douglas and Lane, have a larger stand of merchantable timber. Volume statistics by species and ownership class are given in table 5. These figures include the volume of all conifers 16 inches in diameter or larger, and the volume of all hardwood trees with a diameter of 12 inches or larger.

Table 4.--Land areas, forest land areas and commercial conifer areas by site quality class 1/

Data corrected to January 1, 1944

Kind of forest land and site quality class	Total area		Area in forest land	Area in commercial conifers
	Acres	Percent	Percent	Percent
Commercial conifer				
Douglas-fir				
Class I	2,565	0.1	0.2	0.3
Class II	76,935	5.2	7.2	7.9
Class III	658,205	44.6	61.8	67.3
Class IV	114,545	7.8	10.9	11.7
Class V	2,565	0.1	0.2	0.3
Total	854,815	57.8	80.3	87.5
Spruce hemlock				
Class II	735	2/	0.1	0.1
Class III	21,635	1.5	2.0	2.2
Class IV	65,150	4.5	6.1	6.7
Class V	34,715	2.3	3.3	3.5
Total	122,235	8.3	11.5	12.5
Ponderosa pine				
Class II	210	2/	2/	2/
Total	210			
Total commercial conifer	977,260	66.1	91.8	100.0
Woodland	8,985	0.6	0.9	
Lodgepole pine	17,270	1.2	1.6	
Subalpine	8,690	0.6	0.8	
Noncommercial rocky area	25,270	1.7	2.4	
Hardwood	27,100	1.8	2.5	
Total other	87,315	5.9	8.2	
All forest land	1,064,575	72.0	100.0	
Nonforest land	413,470	28.0		
Grand Total	1,478,045	100.0		

1/ The "site quality" of a forest area is its relative productive capacity, determined by climatic, soil, topographic and other factors. The index of site quality is the average height of the dominant stand at the age of 100 years. Five site quality classes are recognized for both Douglas-fir and spruce-hemlock types and six classes for ponderosa pine types, Class I being the highest. In the survey, the spruce-hemlock classification was used for white fir and fir-mountain hemlock types as well as for western hemlock types.

2/ Less than 0.05 percent.

Table 5.--Volume of timber by species and ownership class
Data corrected to January 1, 1944
Trees 16" and more d.b.h.1/
Thousands of board feet, log scale, Scribner rule

Species	Private	State		County	Municipal	Federal				Total
		Available	Reserved			Revested land grant	Public domain	National forest Available	National forest Reserved	
Douglas-fir										
Large old growth	6,519,049	15,791		26,169		625,742	5,386	2,578,897	7,264	9,778,298
Small old growth	2,731,553	3,705		14,613		430,990	3,296	2,714,431	47,558	5,946,146
Large second growth	1,561,186	3,021		20,993		188,056	1,647	2,509,540	30,739	4,315,182
Small second growth	315,147	1,420	192	7,892	12	25,458	456	244,860	2,035	597,822
Western hemlock										
Large	2,036,943	1,932		8,064		246,391	599	1,420,504	12,803	3,727,236
Small	234,610	215		1,169		30,402	80	30,957	495	297,928
Mountain hemlock	212							111,154	107,970	219,336
Western redcedar										
Live	219,087	330		1,034		11,128		162,295	45	394,719
Dead	239					65		91		395
Alaska yellow-cedar								579		579
California incense-cedar	1,762									1,762
Western white pine	26,107			289		955		73,450	12,510	113,311
Ponderosa pine	1,010									1,010
Sugar pine	660			10		670		8,398		9,738
Lodgepole pine								2,051		2,051
Pacific silver fir	97,238			917		1,670	39	260,947	31,552	392,363
Grand fir	85,068			840		7,212	145	608	924	94,887
Noble fir	236,353	2		1,492		18,918	115	505,214	43,567	805,691
Alpine fir								2,687		2,687
Englemann spruce	4,351							15,734	1,146	21,231
Red alder	9,383	40		86		918	14	545		10,986
Bigleaf maple	44,189	115		365		4,983	79	355		50,006
Black cottonwood	13,600	160		146	475		200	33		14,614
Oregon ash	35									35
Total	14,138,882	26,731	192	84,079	487	1,593,558	12,056	10,643,450	298,658	26,798,093

1/ Trees of hardwood species taken from 12" and more d.b.h.

Douglas-fir volume totals 20.6 billion board feet with 47 percent in large old-growth timber, 29 percent in small old-growth timber, 21 percent in large second-growth timber and 3 percent in small second-growth trees. Western hemlock volume amounts to 4.2 billion feet and the four balsam firs have a combined volume of 1.3 billion feet. The volume of all other species, both hardwoods and conifers, totals 0.7 billion feet.

Some of the heaviest remaining stands in the Douglas-fir region are found in this county. A single township near the headwaters of the Calapooya River has an estimated net volume of 1.3 billion board feet, an average of 62,500 board feet per acre for the entire township.

Forest Ownership

In appraising the forest situation in a county, information on the ownership pattern is vital. Nine ownership classes were recognized in the survey of Linn County, including four for Federal lands, two for State lands, and one each for county, municipal and private holdings. By area, 49 percent of the forest land is privately owned and 48 percent is owned by the Federal Government; State, county, and municipal governments possess the remaining 3 percent.

The boundary of the Willamette National Forest divides the forest land of the county into two almost equal blocks (figure 1). The forest land west of this boundary is mostly privately owned; the eastern half, by contrast, is largely owned and administered by the Federal Government.

Private

Individuals or corporations own about 522,000 acres of forest land containing 45 percent of the saw-timber area, 53 percent of the saw-timber volume, and 83 percent of the area of recent cutovers. Individual holdings vary from 10 acres or less to tracts as large as 50,000 acres. The largest concentration of privately owned lands inside the national forest boundary is found along the South Santiam River, where an early Federal grant alloted alternate sections to the builders of the old Santiam wagon road..

Federal

Lands in the Willamette National Forest administered by the Forest Service comprise the second largest ownership in the county. They contain 42 percent of the forest land, 49 percent of the saw-timber area, and 41 percent of the saw-timber volume. National-forest lands also include 83 percent of the noncommercial forest area and their productive capacity is, in general, considerably below that of the forest lands in other ownership classes.

Some 45,000 acres of national-forest land in the county are included in the Mt. Jefferson Wild Area, which extends along the summit of the Cascades from Mt. Jefferson to Three Fingered Jack (figure 1). This high rugged section was established to preserve its scenic attractions in their natural state, and its saw-timber stands are reserved from cutting. The 20,000 acres of saw timber in the reserve, comprised largely of fir-mountain hemlock types have a saw-timber volume of slightly under 300 million board feet of relatively poor quality timber.

Timberlands of the Oregon and California Railroad Grant comprise the third largest ownership. Scattered in checkerboard pattern along the western portion of the mountain zone, they embrace almost 60,000 acres of forest land containing 5 percent of the county's saw-timber area, 6 percent of the saw-timber volume, and 9 percent of the area in recent cutovers.

Public domain, the fourth and smallest of the federal classes, contains 3,085 acres of forest land composed of a number of small tracts all outside the Willamette National Forest.

State, County, and Municipal

Altogether, about 31,000 acres of forest land are held by local governments.

The State of Oregon, with some 19,000 acres of forest land, is the largest owner in the group. Of this acreage, practically all of which is tax-forfeited land acquired from the county, a total of about 13,000 acres is stocked with immature timber, about 5,000 acres is currently deforested, and the remainder is stocked with saw timber. The largest block is found in the Rock Creek drainage, adjacent to the North Santiam River, where about 15,000 acres are administered as a state forest. The state highway parks, in which the timber is reserved from cutting, contain only 210 acres of forest land.

Forest lands, obtained by Linn County through tax foreclosure, aggregated about 12,000 acres on January 1, 1944. Comprised of a large number of small tracts, these lands include a wide assortment of forest types, including saw timber as well as immature second growth and cutovers. These lands usually remain in county ownership for a relatively short period since under current practice they are either disposed of at tax sales or turned over to the State for state forests. Only 120 acres of forest land are accounted for by municipal ownership.

Forest Growth

The drain placed upon Linn County's forest resource by logging and fire is partially offset by the normal processes of tree growth. Current annual growth, based on data obtained in the 1944 survey, is estimated to be about 84 million board feet or 36 million cubic feet (table 6). This represents the net increment on 410,000 acres of commercial forest land that support second-growth stands (160 years or younger). It was assumed that growth on 487,000 acres that contain older age classes is about equalled by losses due to mortality, windthrow and decay. Slightly over four-fifths of the current growth is being furnished by Douglas-fir types.

Table 6.--Current annual growth by forest type group, 1944

Type group	Area of growing stands (thousands of acres)	Current annual growth	
		Of trees 15.1 inches d.b.h. and larger (millions of board feet)	Of trees 5.1 inches d.b.h. and larger (millions of cubic feet)
Douglas-fir	345	71	30
Western hemlock	9	3	2
Fir-mt. hemlock	29	9	3
Total conifer	383	83	35
Total hdwd.	27	1 1/	1
TOTAL, all commercial types	410	84	36

1/ In computing board-foot growth of hardwoods, all trees 11.1 inches d.b.h. and larger were included.

Barring disastrous fires and major outbreaks of forest insects or diseases, annual volume growth in the county may be expected to increase gradually as the more or less static old-growth timber is cut and replaced by growing stands and as recent cut-over lands restock.

A second type of growth estimate--potential annual growth--was also computed to furnish a measure of the growth that can eventually be realized if the bulk of the county's forest land is intensively managed for continuous production. In this estimate, all conifer lands, including those currently deforested, are assumed to be occupied by growing stands averaging 75 percent of full stocking and with all ages up to rotation age (100 years) equally represented. The resulting figures (table 7) indicate that under present utilization standards the conifer lands of the county are capable of producing 286 million board feet annually--a figure 3½ times the current rate.

Assuming that the current trend toward more complete utilization continues, potential annual growth can be placed at 446 million board feet (trees 11.1 inches d.b.h. and larger) or 94 million cubic feet (trees 5.1 inches d.b.h. and larger).

Table 7.--Potential annual growth on commercial conifer land

Type group	Area (thousands of acres)	Potential annual growth		
		for trees 15.1 inches d.b.h. and larger (millions of board feet)	for trees 11.1 inches d.b.h. and larger (millions of board feet)	for trees 5.1 inches d.b.h. and larger (millions of cubic feet)
Douglas-fir	855	252	399	84
Other conifer types	122	34	47	10
Total	977	286	446	94

Forest Depletion

Current depletion of the county's timber resource is largely the result of cutting sawlogs, forest fires, and cutting of minor forest products. Natural agencies such as insects, disease, and windthrow take a continual toll, but such losses are considered normal and were allowed for in the growth estimates. No tree disease or forest insect attacks have reached epidemic proportions in recent years and the areas of timberland currently being cleared for farm use are negligible.

Records on annual sawlog production since 1925 are available. Sawlog production averaged 51 million board feet for the 5-year period, 1925-29 (table 8), dropped to 45 million for the early depression years, 1930-34, increased to 131 million during the late 1930's, and reached an average of 523 million board feet for the 4-year period ending December 31, 1943. The latter figure provides a measure of current sawlog depletion, although it is highly conservative since the 1942 and 1943 cuts exceeded the average by 10 percent and 39 percent, respectively. With the exception of 1938, sawlog production has increased each year from 1932 to 1943.

A substantial volume is also removed in the form of piling, posts, fuelwood, and pulpwood. The quantity of material going into these so-called minor products was estimated in 1930 3/ to total 14 million board feet from trees of saw-timber size, in addition to 2 million cubic feet from trees of less than saw-timber size. Statistics for more recent years are not available but the production of minor products, especially poles and piling, has increased substantially and is believed to currently average at least 25 million board feet per year.

In the 11-year period between inventories, fire losses in merchantable timber have been relatively light. On the average, 200 acres of timber have burned over and a volume of about 1½ million board feet has been killed yearly. Where fires have occurred adjacent or near to logging operations, a portion of the fire-killed timber has often been salvaged. Assuming that about one-third of the fire-killed timber is eventually used, net volume depletion resulting from fires averages about 1 million board feet yearly.

Average annual timber drain from both fire and cutting can be placed at about 549 million board feet for the 4-year period, 1940-43. If the present trend in sawlog production continues, however, annual depletion may exceed a billion board feet before it reaches its peak.

Table 8.--Average annual production of sawlogs and lumber for specified periods, 1925-43

Period	Average annual sawlog production (M board feet, log scale, Scribner rule)	Average annual lumber production (M board feet lumber tally)
1925 - 1929	50,720	36,154
1930 - 1934	45,028	30,893
1935 - 1939	131,218	96,451
1940 - 1943	522,885	224,312

Forest Industry

Forest industry is second only to agriculture as a basic source of income to the people of Linn County. Census reports show that of 11,000 workers living in the county in 1940, 1,724 or 15 percent, were engaged in harvesting and manufacture of forest products. Approximately

3/ Johnson, Herman M. The Production and Consumption of Minor Timber Products in Oregon and Washington. Office report, Pacific Northwest Forest and Range Experiment Station, 1931.

half of the forest industry group were employed in logging and the remainder worked in sawmills, planing mills, pulp and paper or plywood plants. Since sawlog production increased 2.5 times and lumber production 1.8 times between 1940 and 1943, the forest industry labor force is now believed to number at least 3,000.

Over 100 companies or individuals carried on logging operations in Linn County during 1943. These vary in size from two-man outfits producing 40,000 board feet of logs or less per year, on a part-time or seasonal basis, to highly mechanized company operations with a yearly output of 50 to 100 million board feet. While trucks are used almost exclusively as a primary means of transporting logs out of the woods, railroads are widely used for final shipment to sawmills and other manufacturing plants. A large volume of logs is also trucked to Albany, rafted, and towed to mills and log markets in the lower Columbia River district.

Expansion in sawmill activity has almost kept pace with the rapidly growing logging industry. Average annual lumber production has increased from less than 40 million board feet for the 10 years prior to 1935 to 224 million board feet for the 4-year period 1940-43 (table 8). In 1943, the 52 active sawmills in the county produced slightly over 275 million board feet. In comparison with large tidewater mills of the Lower Columbia River and Oregon coast districts, sawmills of Linn County are relatively small in size. Only 19 have rated capacities (per 8-hour shift) of 25,000 board feet or more, and only 11 are rated at 50,000 board feet or better. The largest, located at Lebanon, can produce about 100,00 board feet of lumber per day.

Linn County has, during recent years, become an important center of Douglas-fir plywood manufacture. Four plants with a combined capacity of 250 million square feet of 3/8-inch, three-ply plywood per year, produce roughly one-third of the plywood manufactured in western Oregon.

The pulp and paper mill at Lebanon represents a further diversification in forest industry. Built in 1890 to manufacture paper from straw, it now produces wrapping papers from wood pulp. With a capacity of 50 tons of paper per day, it provides a local market for many of the hemlock and grand fir logs cut in the county.

Altogether, about three-fifths of the sawlogs cut in Linn County are manufactured into lumber, plywood, or paper in local plants. The remainder are shipped out of the county, largely to mills in the Lower Columbia River Basin.

The Forest Situation Summarized

Practically all of the requisites for the development of a permanent forest industry of substantial size are present in Linn County. Outstanding among its forest assets are over a half million acres of conifer saw timber, largely old-growth Douglas-fir; approximately one-

quarter million acres of immature conifer that is fairly well stocked and making rapid growth; and an over-all saw-timber volume of nearly 27 billion board feet.

Potential growth estimates indicate that the million acres of commercial forest land would eventually yield about 286 million board feet yearly if intensively managed. Growing stands, which now cover only two-fifths of the commercial forest area, are currently adding only about 84 million board feet annually to the county's saw-timber volume.

The rate of timber drain has increased tremendously in recent years due primarily to the rapid expansion in logging activity. Prior to 1935 the total drain from both cutting and fires averaged less than 75 million board feet per year. For the period 1940-43, average annual drain amounted to about 549 million board feet, with sawlog depletion alone reaching 729 million board feet in 1943. The current rate of depletion is obviously far in excess of either current annual or potential annual growth.

To provide a measure of the extent of overcutting, the annual cut allowable under sustained yield from the unreserved commercial forests in the county was determined through use of the Hanzlik formula. 4/ Providing that the timber now mature will be harvested during a 100-year period and that growing stands will be managed on a 100-year rotation, this formula would allow an annual cut in the neighborhood of 366 million board feet. 5/ This assumes that at least half of the area now deforested will restock promptly and adequately and that no cutting will take place in immature stands prior to the rotation age. This theoretical annual cut is based upon a number of assumptions that probably will not all materialize, however; it clearly indicates that current logging activity greatly exceeds the sustained yield capacity of the forest resource and that many timber holdings are being operated on a liquidation basis. Overcutting in mature timber and premature cutting of second growth are now justified on the basis of the vital need for lumber and other wood products during the war emergency. If such practices are carried over into the post-war period, however, future timber supplies in the county will be seriously reduced.

4/ Allowable cut equals the volume of merchantable mature timber divided by the number of years in the rotation, plus the actual mean annual increment of the immature stands for the rotation.

5/ In computing allowable cut, about 300 million board feet of little used species such as mountain hemlock, alpine fir and lodgepole pine were excluded from the mature timber volume. Mean annual increment for immature stands is based on utilization of trees 11.1 inches d.b.h. and larger.

Some of the effects of the rapid expansion of forest utilization in recent years on the county's forest resource can be obtained from a comparison of statistics obtained in the original inventory in 1932 with those obtained in the reinventory in 1943. Such a comparison follows:

Comparison of Inventories

	1932	1943	Percent of Change
Forest land (in thousands of acres)			
Conifer saw-timber stands	667	609	-9
Conifer second-growth (6-20 inches d.b.h.)	135	207	+53
Conifer seedling and sapling stands (0-6 inches d.b.h.)	77	53	-31
Hardwoods	21	27	+29
Nonrestocked cutovers and burns and recent cutovers	49	108	+120
Noncommercial forests	65	60	-8
Total	1,014	1,064	+5
Saw-timber volume (in millions of board feet)			
Douglas-fir old growth	18,414	15,724	-15
Douglas-fir second growth	5,223	4,913	-6
Pulp species	6,531	5,540	-15
Other conifers	601	524	-13
Hardwoods	107	97	-9
Total	30,876	26,798	-13

The 5-percent increase in total area of forest land in the county resulted from reclassification of some of the areas in the agricultural zone which were originally mapped as agricultural. The large increase in area of conifer second growth, 6 to 20 inches in diameter, resulted from the moving up of a large number of stands from the seedling and sapling class. The 1932 inventory showed a considerable acreage of stands in the 20- and 30-year age classes, stands that were near the upper limit of the seedling and sapling type group. Most of the 120-percent increase in area of nonrestocked cutovers and burns and recent cutovers was due to the large area--90,000 acres--of lands logged since 1930 that were classed in 1943 as recent cutovers. The area of nonrestocked old cutovers and burns decreased materially during the 11 years between inventories.

Better cutting practices, improved protection and management, and stable ownership can do much towards improving the forest situation in the county. Currently, nearly one-half of the unreserved commercial forest land is in public ownership and is being managed on a sustained-yield basis. Included are the federally owned lands administered by the Forest Service and Oregon and California Revested Land Grant Administration, and the State-owned lands.

As old-growth timber supplies in the Douglas-fir region have become increasingly scarce, interest on the part of private owners and operators in growing of timber crops and in acquiring fast-growing immature stands for future yields has heightened appreciably. Evidence of this increased interest is found in the "tree farm" program of the lumber industry which dedicates private forest holdings to the growing of commercial timber crops under improved protection and management practices. To date some 25,000 acres of forest land in Linn County, owned by four individuals or corporations, is included in registered tree farms.

While sustained yield on a county-wide basis would necessitate a sizable curtailment in the present rate of sawlog production, it would permit an annual cut large enough to support the present wood-using industries if the bulk of the sawlogs was diverted to local plants for initial conversion. More complete utilization of the large volume of raw material now left in the woods or wasted in milling and further remanufacture locally of lumber into final products also offer broad possibilities for future expansion.